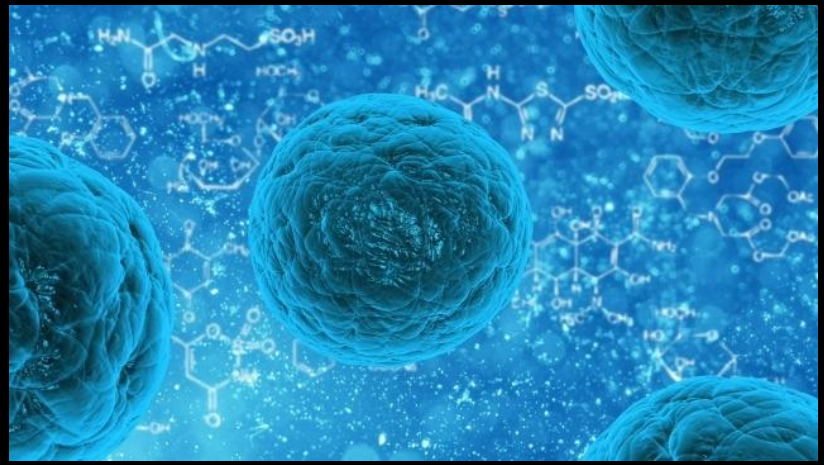
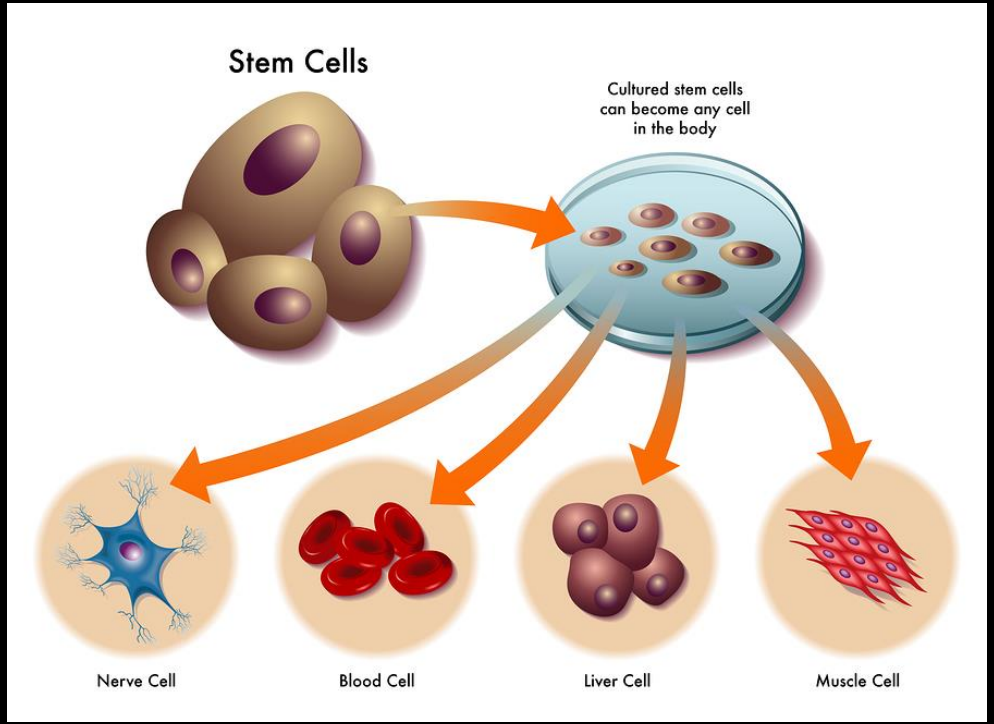
Stem Cells



By: Alexander Isidori, Shawn Alves, John-Paul Gagliano-Veiga, Peter Bello and Stefan Copetti

What are STEM Cells?

- Undifferentiated
- Ability to transform into any specialized cell
- Types
  - Embryonic (Pluripotent)
  - Adult
  - Induced Pluripotent



Alex Isidori

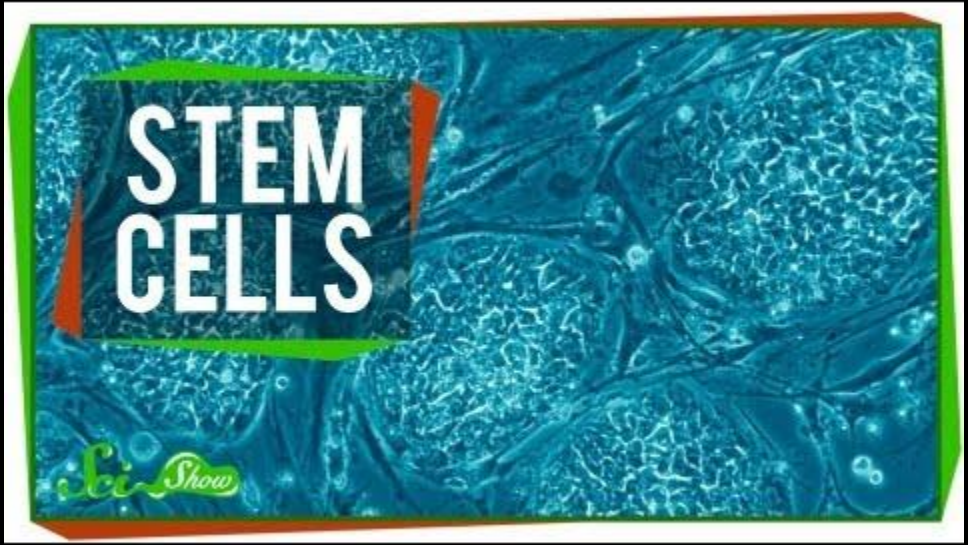
STEM Cell Controversy?

- The Roman Catholic Church and some Protestant religious groups are against the use of embryonic Stem cells.
- They believe human life must be respected as conceived from birth
    - An example of this is where Pope Francis came out and spoke saying “it uses human beings as guinea pigs to presumably save others. This is playing with life."
      (Bill Donohue, Newsmax)

https://az616578.vo.msecnd.net/files/2016/06/02/636004881598307483441862 08_stemcells.gif

Peter Bello

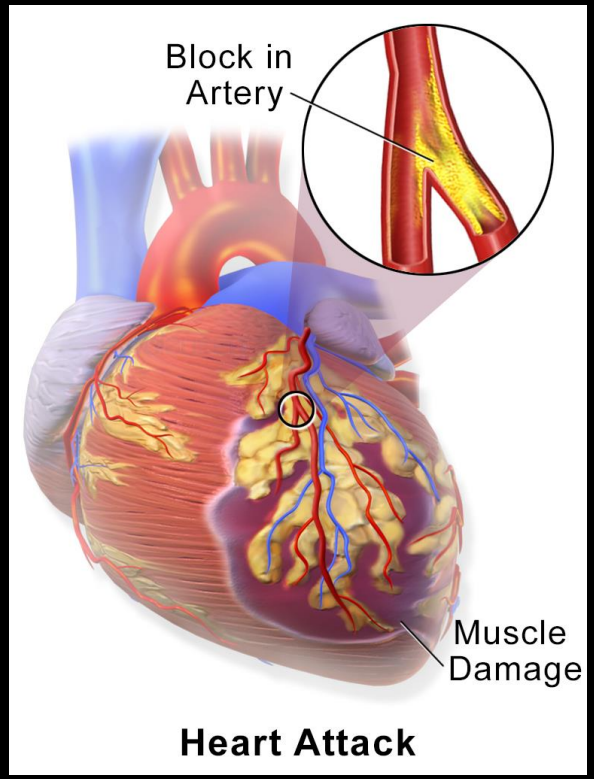
STEM Cells Overview

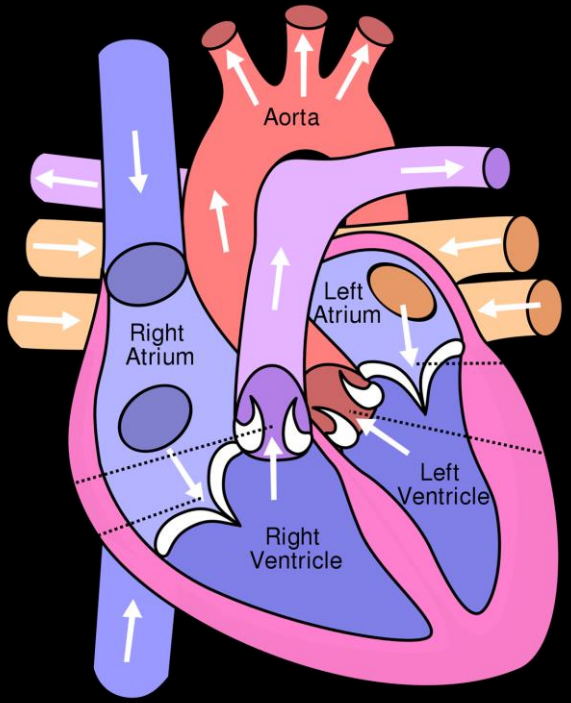


Stem Cells in relation to the heart

By:John-paul Gagliano-Veiga

Healthy heart vs Damaged heart



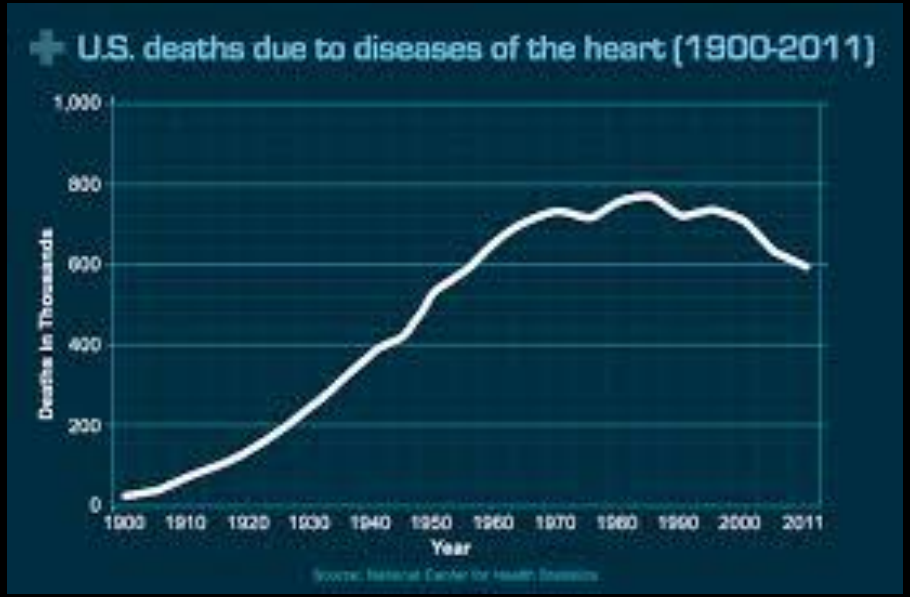


John-paul Gagliano-Veiga

The Numbers Keep Getting Higher

- Cardiovascular disease(CVDs) has been the number 1 cause of death globally
- Plaque fills arteries that make it hard for blood to flow,
- In 2015 17.7 million people died from CVDs
- This counted for 31% of deaths globally

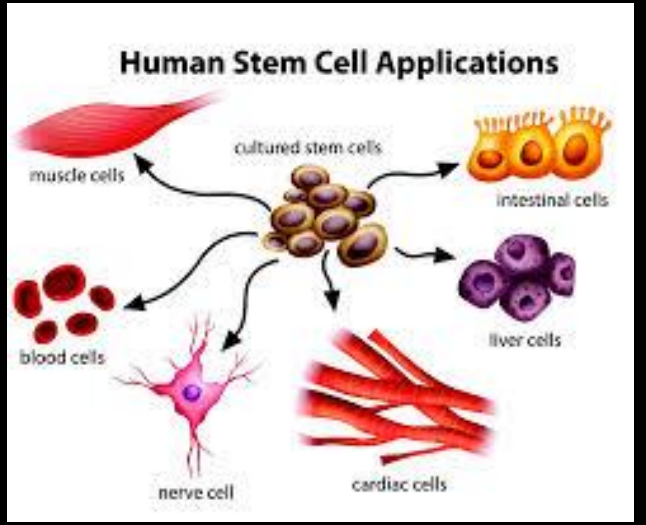
American health association 2017,world health organization 2017



http://news.heart.org/wp-content/uploads/2014/12/HBP-Deaths-12-19-04.jpg

How do stem cells help repair a damaged heart?

- Our heart can be damaged in an array of ways some examples are heart failure, a stroke
- This is when stem cells are able to come in and help
- A study has shown how we are able to use stem cells to improve our heart to a normal functioning heart
- A stem cell becomes a heart muscle cell and replaces the damaged tissue.



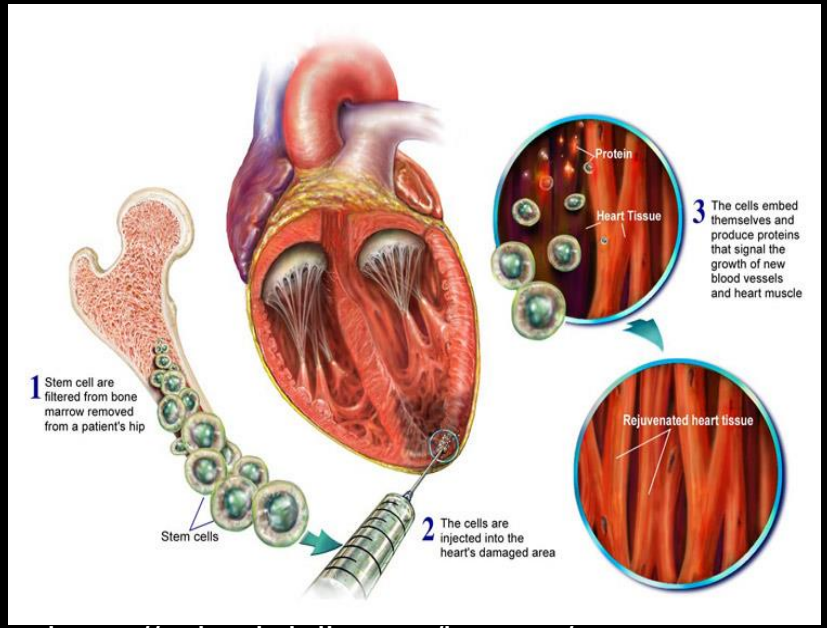
https://www.cryo-cell.com/CryoCell/media/CryoCell/Client-Images/stem-cell-differentiation.png

American college of cardiology, 2016

John-paul Gagliano-Veiga

The study of how stem cells can repair a damaged heart

- The study shows that we are able to take stem cells from our bone marrow
- The doctor will have to wait 7-11 days to plant them into the heart's damaged area
- Then the stem cell will be programmed into heart tissue and make it into a regular functioning heart



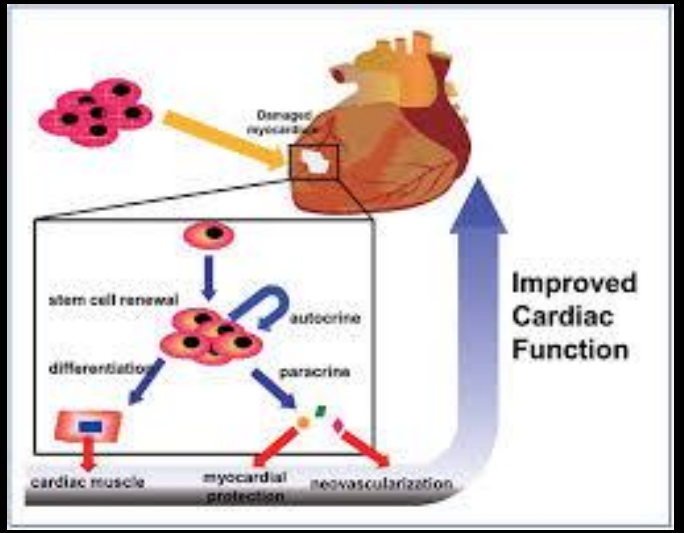
https://scitechdaily.com/images/stem-cells-heart.jpg

American college of cardiology, 2016

John-paul Gagliano-Veiga

How successful was the trial on healing on a Damaged heart

- In general, Stem cells are very beneficial for humans but they do cause controversy
- Stem cells can be used in many different part of the body
- In general they have improved the survival rate
- People that were given stem cells that had cardiovascular problems 3.4% died and 37.9% hospitalized compared to 13.7% died and 49.0%

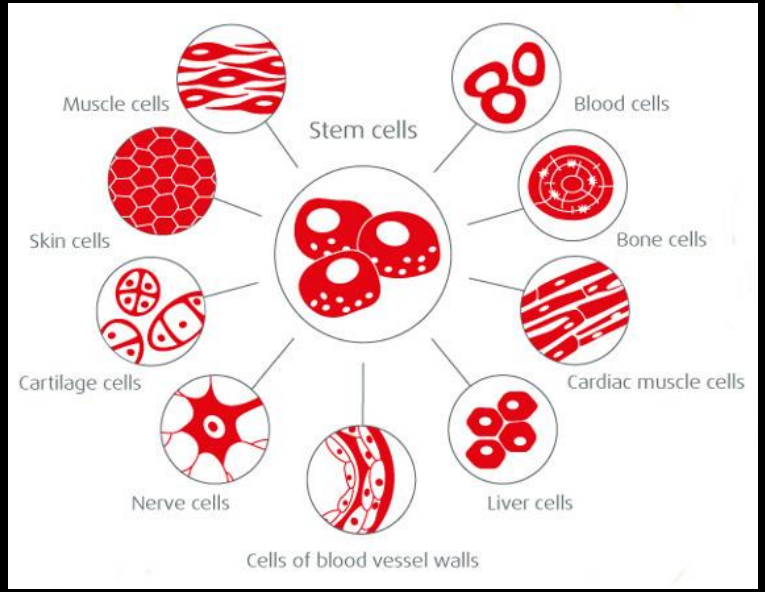


John-paul Gagliano-Veiga

American college of cardiology, 2016

The risks of injecting stems cells into the heart

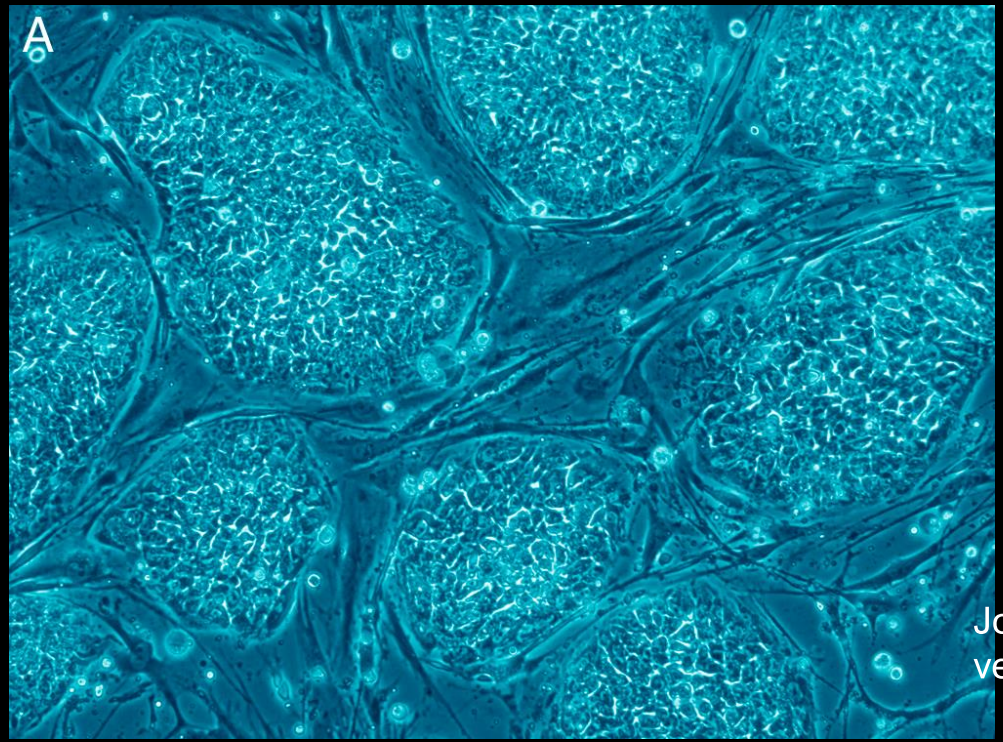
- Like with any therapy there is risk
- The body’s immune system could reject the stem cells
- If they don’t communicate with the brain they can cause problems like make the heart beat too fast
- Other then that there has been no other short term problems but long term effects aren't certain



Harvard, 2013

John-paul Gagliano-Veiga

Relating stem cells to society

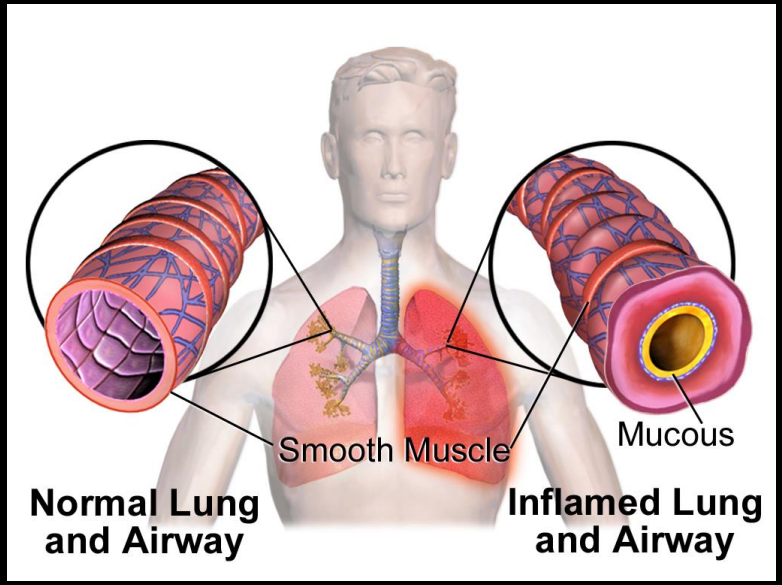


Johnpaul gagliano veiga

Stem Cells in relation to the lungs

Done By:
Stefan Copetti

Injured Lung vs Healthy Lung



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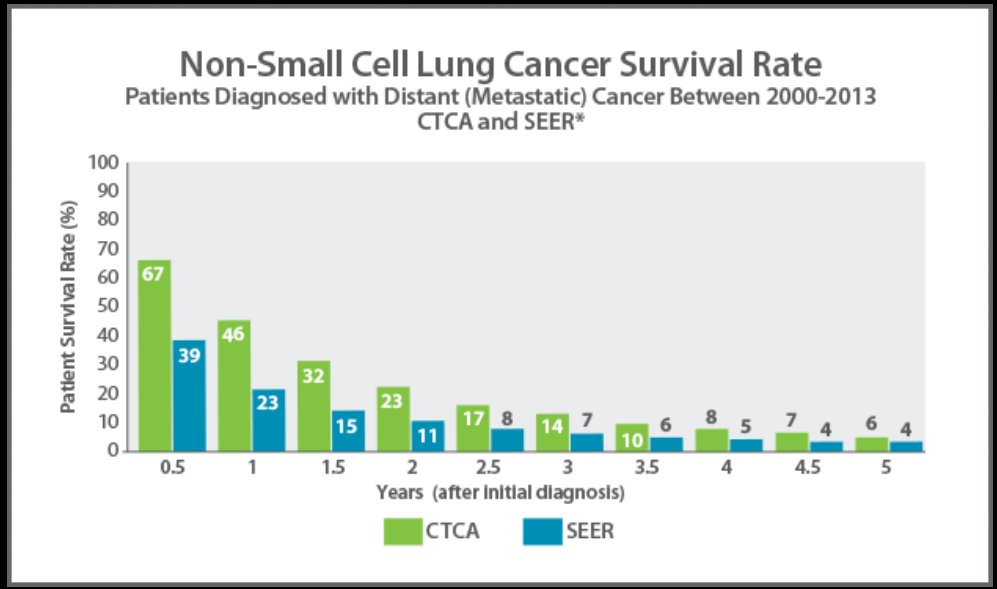
Stefan Copetti

Statistics on Lung Injuries

- Despite extensive research into the development of acute lung injury and the acute respiratory distress syndrome, mortality rates stay at 40%.
- Lung cancer is one of the most common diseases in the Lung.
- Another example similar to lung cancer is COPD
- The five-year survival rate for Canadians with lung cancer is far behind that of other major cancers (Lung cancer: **15%)**



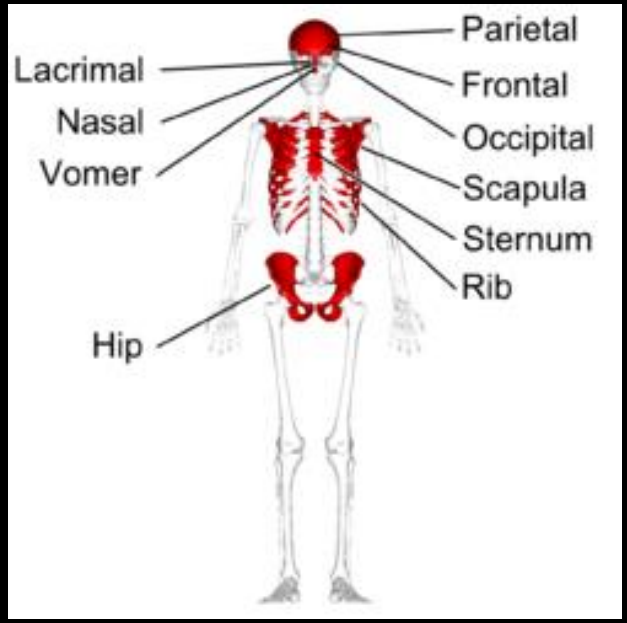
(IMAGE) https://www.google.ca/search?safe=strict&rlz=1C1NHXL_enCA694CA694&biw=1600&bih=794&tbm=isch&sa=1&ei=N0H2Wb6RO8rIjwTow4mADA&q=lung+cancer+survival+rates&oq=lung+cancer+survirates&gs_l=psy-ab.1.0.0i13k1l2.12031.14602.0.16048.15.11.0.0.0.0.198.1046.3j6.9.0....0...1.1.64.psy-ab..7.7.790...0j0i8i13i30k1j0i7i30k1j0i24k1j0i8i7i30k1j0i13i30k1j0i13i5i30k1.0.2s2U1RR24_8#imgrc=xEpxqRo8uDIW7M:

Regenerative Cell Treatment for COPD & Emphysema Airway Lung Repair. (n.d.). Retrieved October 26, 2017, fromhttps://stemcellthailand.org/therapies/copd-chronic-obstructive-pulmonary-disease/

Stefan Copetti

How did the Stem cell experiment go?

- Transplantation studies in mice can be performed using whole donor bone marrow, termed marrow stromal cells (MSC) or preparations enriched for hematopoietic stem cells (HSC)
- Whole body irradiation (X-rays), which may injure lung tissue, uses up the host bone marrow
- Importantly, Stem cells have proven to help repair the lung of a mouse
- Sex-mismatched lung and bone marrow transplantation in mice provides a good example of what it would do to a human



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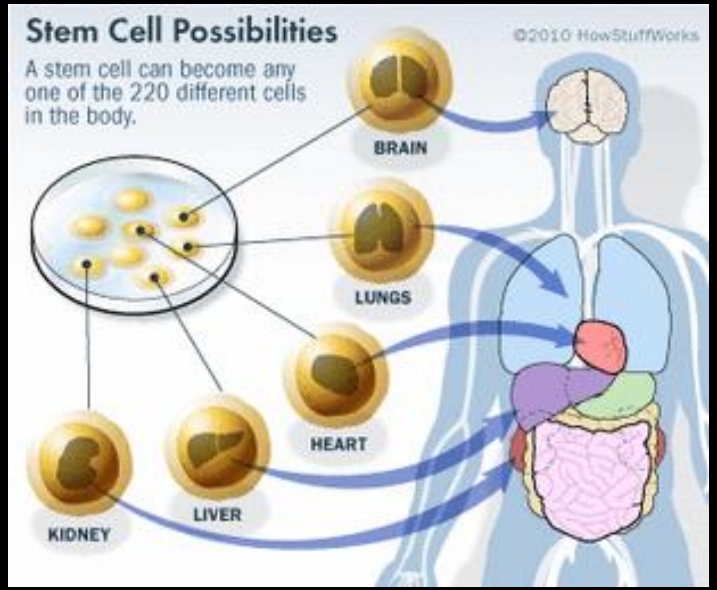
Neuringer, I. P., & Randell, S. H. (2004, July 20). Stem cells and repair of lung injuries. Retrieved October 26, 2017, from https://respiratory-research.biomedcentral.com/articles/10.1186/1465-9921-5-6

By: Stefan Copetti

How do Stem Cells help to repair lung injuries?

- Our Lungs are exposed to an array of potentially devastating chemicals
- This is where Stem Cells come into play
- The lung will allow the Stem cells or bone marrow to enter so they can transplant their cells to try and cure the problem in the lung
- The transplant has proven to be successful in most cases, but it does not have a 100% success rate



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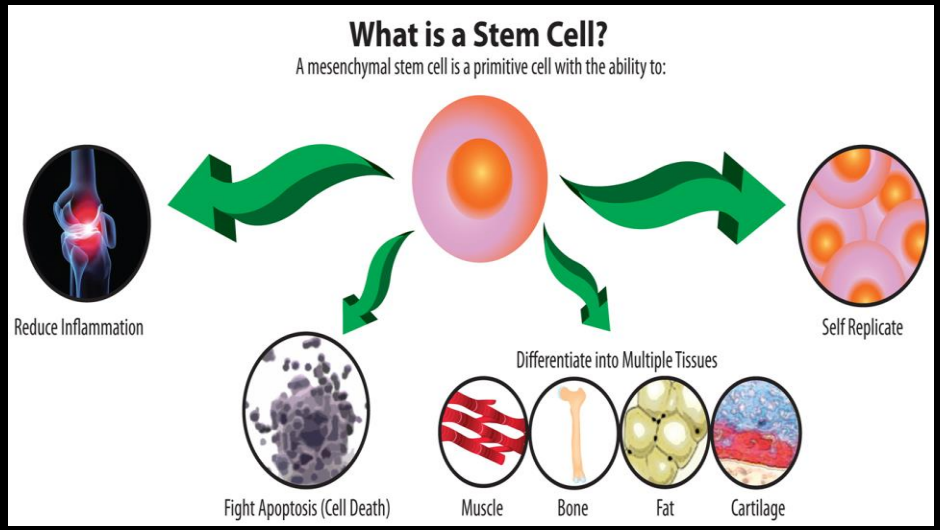
Neuringer, I. P., & Randell, S. H. (2004, July 20). Stem cells and repair of lung injuries. Retrieved October 26, 2017, from https://respiratory-research.biomedcentral.com/articles/10.1186/1465-9921-5-6

Stefan Copetti

How successful have Stem Cells been?

- Overall, Stem cells are beneficial but they cause some controversy
- Cloning human embryos for stem cells is very controversial
- One of the good things about stem cells is that they are not all the same.
- They can become any one of 220 cells in the body



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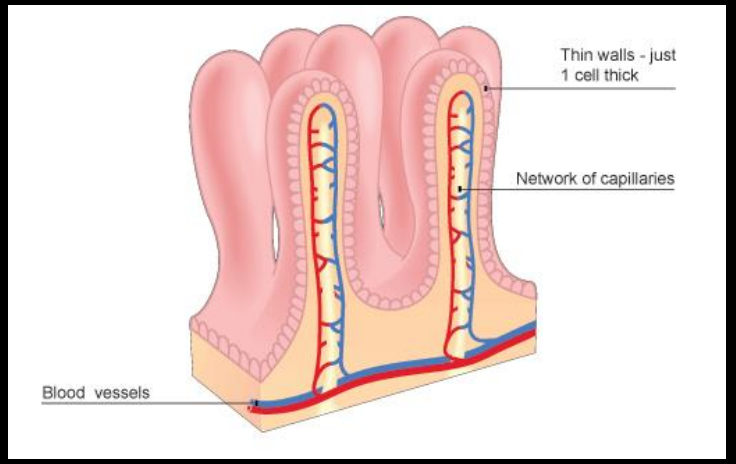
Stem Cells Fast Facts. (2017, June 02). Retrieved October 27, 2017, from http://www.cnn.com/2013/07/05/health/stem-cells-fast-facts/index.html

Stefan Copetti

How the repair of lungs Affects STSE

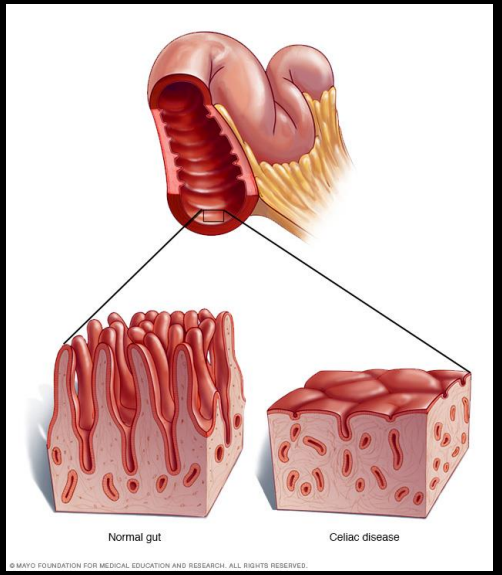
Stem Cells in relation to the Small Intestines and Villi



By: Peter Bello

Celiac Disease

- Celiac disease is an autoimmune disease.
- Celiac disease is when people have problems digesting gluten, which triggers an immune response that is not normal
- Stem cell therapy could help Celiac patients by replacing the damaged villi with normal villi. This treatment is still being tested by researchers.



http://www.celiacns.ca/wp-content/themes/celiac-ns/library/img/celiac-logo.png

https://www.mayoclinic.org/-/media/kcms/gbs/patient-consumer/images/2013/08/26/10/49/ds00319_im04515_mdc7_celiac_diseasethu_jpg.jpg

Peter Bello

Healthy Villi vs Damaged Villi

Normal Intestinal Villi
(Source: library.med.utah.edu)

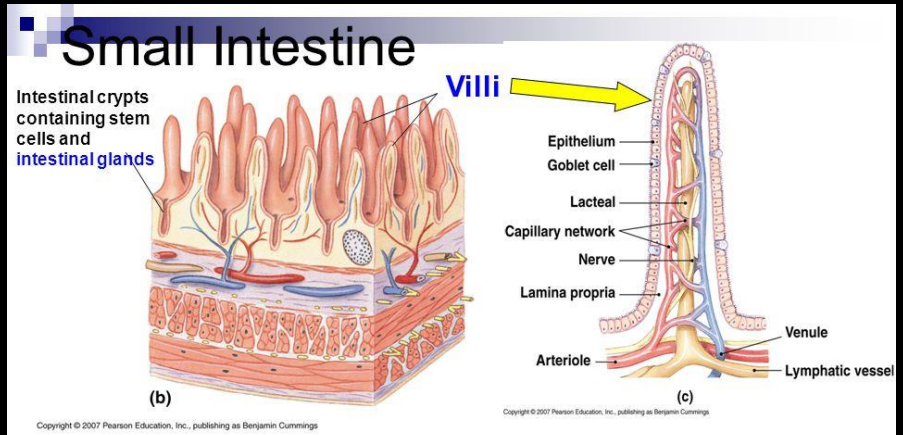
Damaged Villi (Celiac Disease)
(Source: https://commons.wikimedia.org/wiki/User:Nephron)

http://www.glutenfreehomestead.com/2016/05/why-a-gluten-free-diet-doesnt-completely-heal-many-celiacs/

Peter Bello

How do Stem Cells Help Repair the Small Intestine?

- The small intestine contains small finger like tissues called villi.
- Some Stem cell growth can initially serve as a patch covering organs while allowing the intestines to naturally heal.
- Researchers have tested the growth of Stem cells in mice and have found that it can help in the repair process of the intestines.



http://slideplayer.com/slide/2817550/10/images/24/Small+Intestine+Villi.+Intestinal+crypts+containing+stem+cells+and+intestinal+glands..jpg

Peter Bello

The Study of How Stems Cells can Heal Damaged Villi

- Wellcome Trust-Medical Research Council Cambridge Stem Cell Institute at the University of Cambridge and at BRIC, have undertaken an experiment to transplant a source of gut Stem cells that can repair small intestines in mice.
- The experiment transplanted growth Stem cells into mice.
- Dr Kim Jensen, who led the study said: “We found out that the cells formed a living plaster over the damaged gut. They seemed to respond to the environment they had been placed in and matured accordingly to repair the damage.” (Science Daily, October 17,2013)

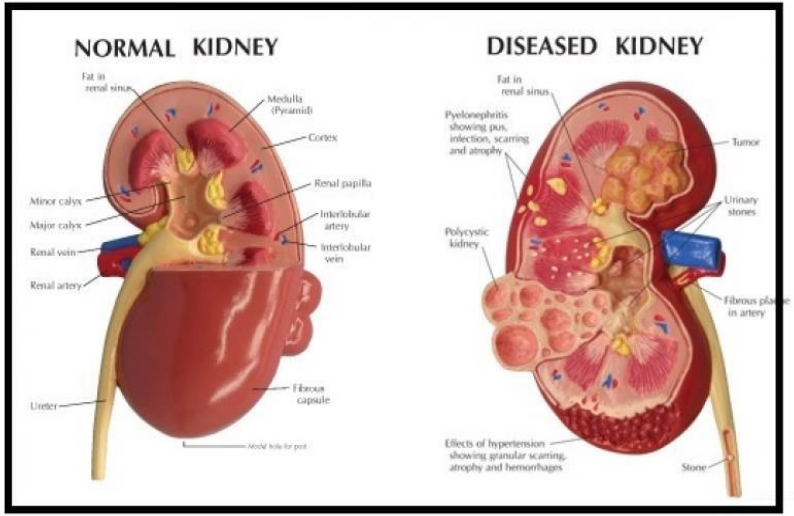
Peter Bello

Chronic Kidney Disease and Stem Cells

Done By:
Alex Isidori

Chronic Kidney Disease

- A bean shaped organism that extracts and balances bodily fluids
- (A.K.A Kidney failure) It is the gradual loss of kidney function
- Diseases that cause Chronic Kidney Disease
  - High Blood Pressure
  - Type 1&2 Diabetes
- Can cause Severe Anaemia



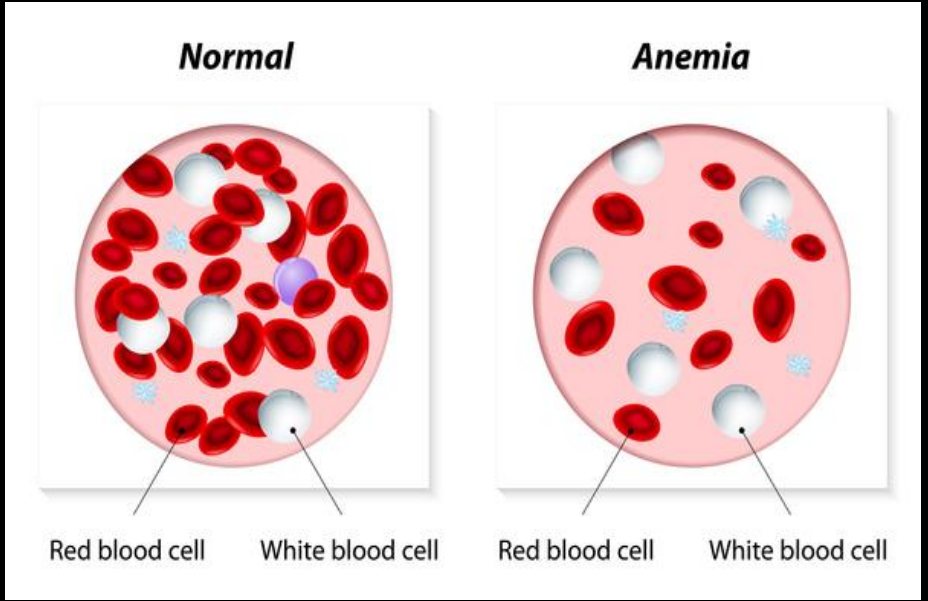
Staff, M. C. (Ed.). (2017, August 4). Chronic Kidney Disease. Retrieved October 20, 2017, from https://www.mayoclinic.org/diseases-conditions/chronic-kidney-disease/symptoms-causes/syc-20354521

(IMAGE) Brahm Ayurved, %. (2016, May 16). Kidney Failure. Retrieved October 28, 2017, from http://health.brahmayurved.com/Kidney-Failure-Renal-Failure-Chronic-renal-failure-chronic-kidney-disease-CRF-CKD-The-main-function-of-the-kidneys-is-to-remove-waste-products-and-exc/b26

Alex Isidori

What is Anaemia?

- Lack of blood
- Caused by the inability to replace red blood cells lost
- Often associated with
  - Low iron
  - Low volume of blood in digestive system



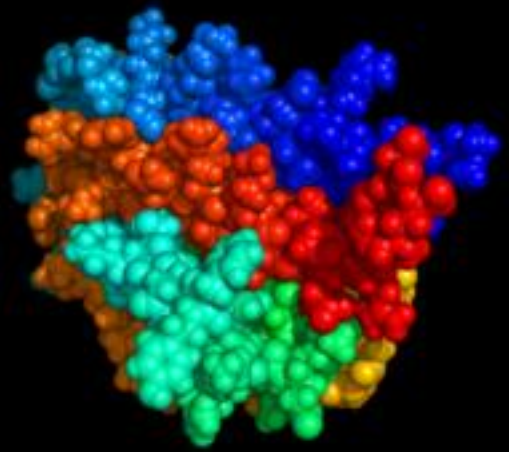
Blaser, L. (2004). Anemia . Retrieved October 20, 2017, from http://go.galegroup.com/ps/i.do?p=GVRL&u=ko_k12hs_d62&v=2.1&it=r&id=GALE%7CCX3418500113&inPS=true&linkSource=interlink&sid=AONE&authCount=1

(IMAGE) Anemia. (n.d.). Retrieved October 28, 2017, from http://cmc.ph/health-conditions/anemia/

Alex Isidori

Chronic Kidney Disease and Red Blood Cells?

- When CKD occurs production of the hormone Erythropoietin is reduced
- Erythropoietin
  - An essential hormone to the production of red blood cells, without it erythropoiesis does not occur
  - Erythropoiesis is the production of red blood cells



Unknown. (2017, September 27). Erythropoietin . Retrieved October 20, 2017, from https://en.wikipedia.org/w/index.php?title=Erythropoietin&action=history

(IMAGE) Erythropoietin . (2017, September 27). Retrieved October 28, 2017, from https://en.wikipedia.org/wiki/Erythropoietin

Alex Isidori

Mice Experiment

Method

- Murine model of acute renal failure (ARF)

Materials

- Female mice or Male mice
- Cisplatin
- Saline
- Mesenchymal Stem Cells (MSC)
- Hematopoietic Stem Cells (HSC)

*MSC/HSC derived from male bone marrow

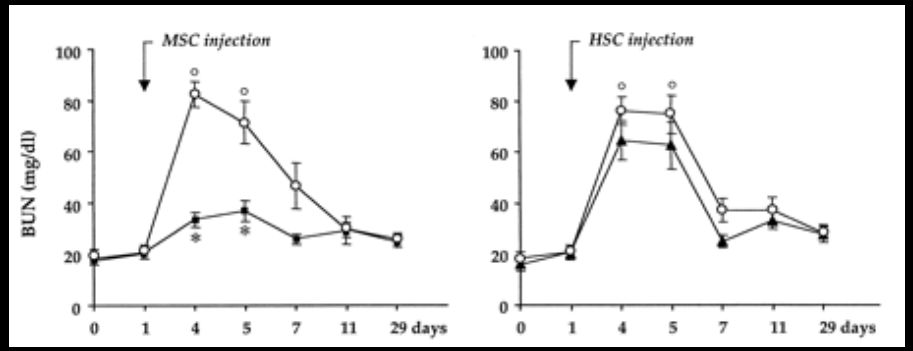
Morigi, M., Imberti, B., Zoja, C., Corna, D., Tomasoni, S., Abbate, M., . . . Remuzzi, G. (2004, March 30)
Mesenchymal Stem Cells Are Renotropic, Helping to Repair the Kidney and Improve Function in Acute Renal Failure. Retrieved October 20, 2017, from http://jasn.asnjournals.org/content/15/7/1794.full.pdf html

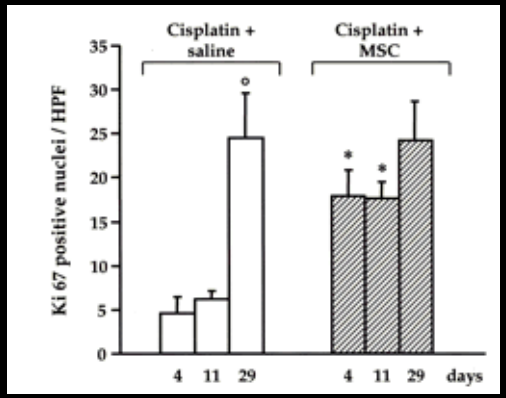
Alex Isidori

Data

Results

- MSC can cure ARF
- MSC and Tubular cells/structure
- HSC Fail to Protect Cisplatin-Treated Mice





Morigi, M., Imberti, B., Zoja, C., Corna, D., Tomasoni, S., Abbate, M., . . . Remuzzi, G. (2004, March 30). Mesenchymal Stem Cells Are Renotropic, Helping to Repair the Kidney and Improve Function in Acute Renal Failure. Retrieved October 20, 2017, from http://jasn.asnjournals.org/content/15/7/1794.full.pdf html

Alex Isidori

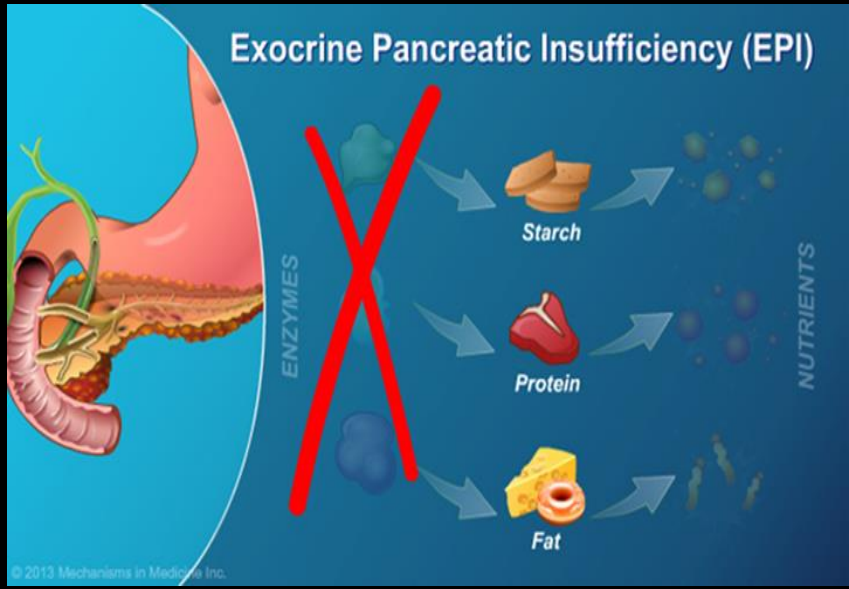
Relation to STSE

Stem Cells in relation to the pancreas

Done by: Shawn Alves

Pancreatic endocrine

- Condition caused by a shortage of enzymes
- Maldigestion or inability to digest food
- Amylase speeds up the breakdown of starch into sugars
- Protease speeds up the breakdown of protein into amino acids
- Lipases speeds up the breakdown of fats and oils into fatty acids and glycerol



Shawn Alves

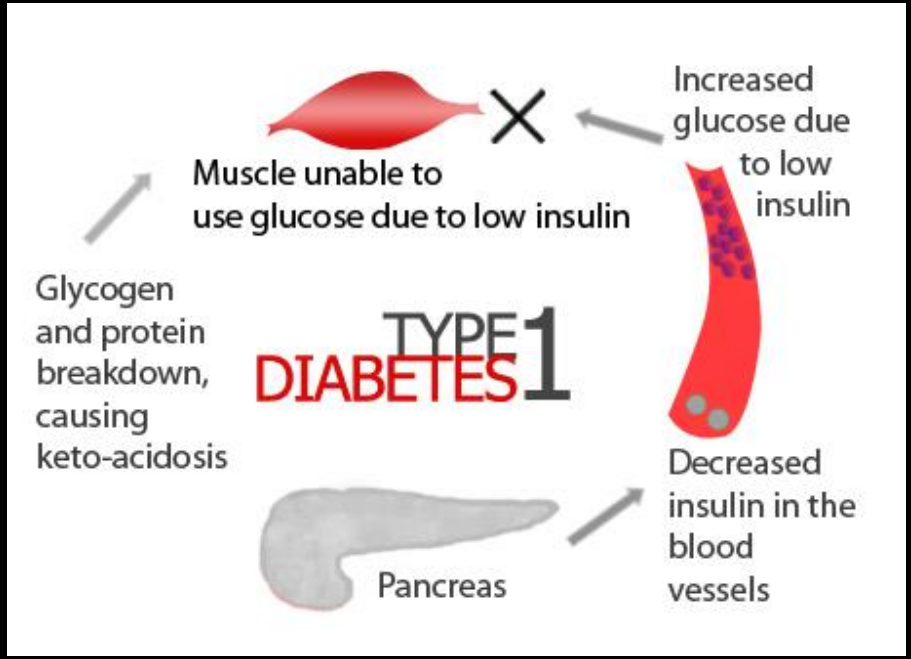
Background

- Department of Histology; Iuliu Hatieganu University of Medicine and Pharmacy
- Conducted in 2001
- Cluj-Napoca, Romania

Shawn Alves

Introduction

- Correct the alterations that appear in different degenerative diseases.
- Low regrowth capacity
- Perfect for cell therapy in the hope of restoring its function and curing diabetes mellitus



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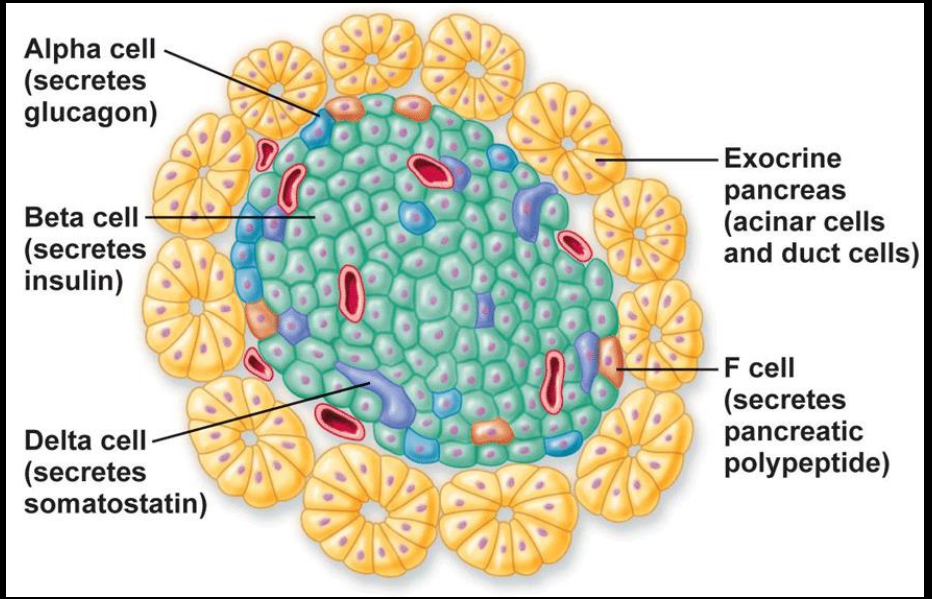
Method

- Adult pancreatic cells were cultured together with mesenchymal stem cells isolated from human placenta
- Seeded pancreatic cells on a pre-adhered single-cell layer of mesenchymal stem cells
- Seeding two cell populations in suspension



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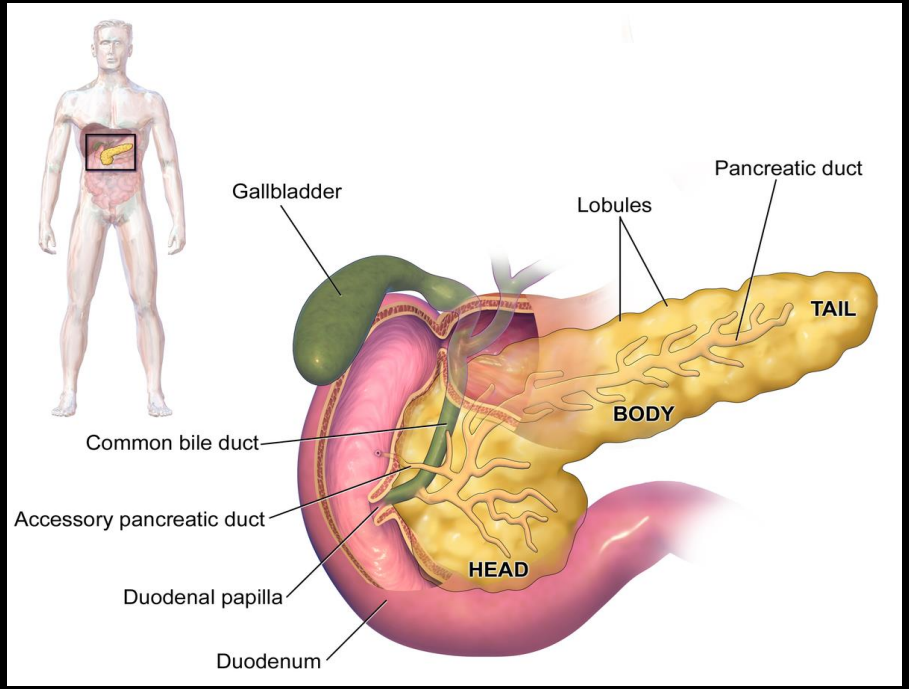
Results and conclusion

- Placental ones have determined a change in observed characteristics from mesenchymal to epithelial-like.
- Brings out the plasticity of placental stem cells



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